THE UTILITY AND VALIDITY OF KINEMATIC GPS POSITIONING FOR THE GEOSAR AIRBORNE TERRAIN MAPPING RADAR SYSTEM

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GeoSAR is an airborne, interferometric Synthetic Aperture Radar (IfSAR) system for terrain mapping, currently under development by a consortium including NASA's Jet Propulsion Laboratory (JPL), Calgis, Inc., a California mapping sciences company, and the California Department of Conservation (CalDOC), with funding provided by the U.S. Army Corps of Engineers Topographic Engineering Center (TEC) and the U.S. Defense Advanced Research Projects Agency (DARPA).

IfSAR data processing requires high-accuracy platform position and attitude knowledge. On GeoSAR, these are provided by one or two Honeywell Embedded GPS Inertial Navigation Units (EGI) and an Ashtech Z12 GPS receiver. The EGIs provide real-time high-accuracy attitude and moderate-accuracy position data, while the Ashtech data, post-processed differentially with data from a nearby ground station using Ashtech PNAV software, provide high-accuracy differential GPS positions.

These data are optimally combined using a Kalman filter within the GeoSAR motion measurement software, and the resultant position and orientation information are used to process the dual frequency (X-band and P-band) radar data to generate high-accuracy, high -resolution terrain imagery and digital elevation models (DEMs). GeoSAR requirements specify sub-meter level planimetric and vertical accuracies for the resultant DEMs. To achieve this, platform positioning errors well below one meter are needed. The goal of GeoSAR is to obtain 25 cm or better 3-D positions from the GPS systems on board the aircraft.

By imaging a set of known point target corner-cube reflectors, the GeoSAR system can be calibrated. This calibration process yields the true position of the aircraft with an uncertainty of 20-50 cm. This process thus allows an independent assessment of the accuracy of our GPS-based positioning systems.

We will present an overview of the GeoSAR motion measurement system, focusing on the use of GPS and the blending of position data from the various systems. We will present the results of our calibration studies that relate to the accuracy the GPS positioning. We will discuss the effects these positioning errors have on the resultant DEM products and imagery.

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